Amendment to the Claims:

This listing of claims replaces all prior versions, and listings, of claims in the application:

1. (Currently Amended) A method for generating a negative ion in a reversal region, the method comprising:

a) providing an electron emitter comprising ~~a spherically concave~~ an electron-emitting surface for generating an electron beam comprising electrons;

b) providing a lens stack comprising 1) an electron extractor for electrostatically focusing the emitted electrons along an ~~axes~~ axis to a reversal region and 2) an electrostatic mirror for neutralizing the kinetic energy of the electrons;

~~c) determining the geometry of the lens stack;~~

d) c) determining the fields and trajectories for the electrons ~~comprising the electron beam~~ by ~~analytically~~ determining the axial and radial kinetic energy of electrons at the electrostatic mirror, wherein the trajectories of the electrons at the electrostatic mirror are calculated in ~~a spherical~~ an electric-field configuration that is matched to the geometry of the electron-emitting surface;

~~e)~~ d) determining the number of reflections made by the electron beam in the reversal region;

~~f)~~ e) modifying the geometry of the lens stack in light of ~~comparing~~ the results obtained in ~~d)~~ c) ~~with~~ and the results obtained in ~~e)~~ d), wherein the lens stack is modified to provide an electron kinetic energy of 2 meV or less and at least 5 reflections at the reversal region; and

~~g)~~ f) intersecting the reversal region with a target molecular gas beam comprising a target molecule, wherein electrons attach to the target molecule and a negative ion is formed.

2. (Original) The method of claim 1, wherein the target molecule is present in a liquid, air, or vapor sample.

3. (Original) The method of claim 2, wherein the sample is extracted by solid phase extraction, salting-out solvent extraction or membrane solid phase extraction.

4. (Original) The method of claim 3, wherein the sample is further processed by supersonic expansion in a jet separator prior to introduction.

5. (Original) The method of claim 1, wherein the target molecule is an explosive.

6. (Original) The method of claim 5, wherein the explosive is RDX, TNT, PETN, or EGDN, or any combination thereof or derivative thereof.

7. (Original) The method of claim 1, wherein the target molecule is a nerve agent.

8. (Original) The method of claim 7, wherein the nerve agent is Tabun (GA), Sarin (GB), Soman (GD), GF, V-agent (VX) (phosphonothioic acid, methyl-, S-(2bis(1-methylethylamino)ethyl) 0-ethyl ester) or pyridostigmine, or any combination thereof or derivative therof.

9. (Original) The method of claim 1, wherein the target molecule is a pulmonary intoxicant.

10. (Original) The method of claim 9, wherein the pulmonary intoxicant is phosgene (CG), diphosgene (DP), chlorine or chloropicrin (PS), or any combination thereof or derivative therof.

11. (Original) The method of claim 1, wherein the target molecule is a blister agent.

12. (Original) The method of claim 11, wherein the blister agent is sulfur mustard (H/HD) or nitrogen mustard (HN), arsenicals (lewisite (L)), or phosgene oxime (CX), or any combination thereof or derivative therof.

13. (Original) The method of claim 1, wherein the target molecule is a drug.

14. (Original) The method of claim 13, wherein the drug is heroin or cocaine.

15. (Original) The method of claim 1, wherein the reversal region comprises a plurality of reversal planes of electrons.

16. (Currently Amended) A method for generating low-energy electrons in a reversal region, the method comprising:

a) providing an electron emitter comprising ~~a spherically concave~~ an electron-emitting surface for generating an electron beam comprising electrons;

b) providing a lens stack comprising 1) an electron extractor for electrostatically focusing the emitted electrons along an ~~axes~~ axis to a reversal region and 2) an electrostatic mirror for neutralizing the kinetic energy of the electrons;

~~c) determining the geometry of the lens stack;~~

~~d)~~ c) determining the fields and trajectories for the electrons ~~comprising the electron beam~~ by ~~analytically~~ determining the axial and radial kinetic energy of electrons at the electrostatic mirror, wherein the paths of the electrons at the electrostatic mirror are calculated in ~~a spherical~~ an electric-field configuration that is matched to the geometry of the electron-emitting surface;

~~e)~~ d) determining the number of reflections made by the electron beam in the reversal region; and

~~f)~~ e) modifying the geometry of the lens stack in light of ~~comparing~~ the results obtained in ~~d)~~ c) ~~with~~ and the results obtained in ~~e)~~ d), wherein the geometry of the lens stack is modified to provide an electron kinetic energy of 2 meV or less and at least 5 reflections at the reversal region.

17. (Currently Amended) An apparatus for generating low-energy electrons in a reversal region, the apparatus comprising:

a) an electron emitter comprising ~~a spherically concave~~ an electron-emitting surface for generating an electron beam comprising electrons;

b) a lens stack comprising 1) an electron extractor for electrostatically focusing the emitted electrons along an ~~axes~~ axis to a reversal region and 2) an electrostatic mirror for neutralizing the kinetic energy of the electrons;

c) a means for determining the fields and trajectories for the electrons by analyzing the axial and radial kinetic energy of the electrons at the reversal region, wherein the trajectories of the electrons at the reversal region are calculated in ~~a spherical~~ an electric-field configuration that is matched to the geometry of the electron-emitting surface;

d) a means for determining the number of electron reversals in the reversal region;

e) a means for ~~comparing~~ analyzing the results obtained in d) ~~with~~ and the results obtained in ~~e), wherein~~ so that the geometry of said lens stack ~~is~~ can be matched to the geometry of said electron emitter to thereby ~~providing~~ provide an electron kinetic energy of 2 meV or less and at least 5 reflections at the reversal region.

18. (Original) The apparatus of claim 17 further comprising an ion extraction component in ion communication with the reversal region.

19. (Original) The apparatus of claim 18, further comprising a mass analyzer in ion communication with the extraction component.

20. (Currently Amended) A chemical sensing apparatus for detecting the presence of a target molecule, the apparatus comprising:

a) a gas phase jet separator having at least one first wall adjacent to an injection port, a second wall proximal said injection port and a third wall distal said injection port;

b) an electron-ion optic chamber in vapor communication with the jet separator, the chamber comprising:

1) an electron emitter comprising ~~a spherically concave~~ an electron-emitting surface;

2) a lens stack comprising:

i) an electron extractor for electrostatically focusing the emitted electrons along an ~~axes~~ axis to a reversal region; and

ii) an electrostatic mirror for neutralizing the kinetic energy of the electrons;

c) a means for determining the fields and trajectories for the electrons ~~comprising the electron beam~~ by ~~analytically~~ determining the axial and radial kinetic energy of electrons at the electrostatic mirror, wherein the trajectories of the electrons at the electrostatic mirror are calculated in a ~~spherical~~ an electric-field configuration that is matched to the geometry of the electron-emitting surface;

d) a means for determining the number of reflections made by the electron beam in the reversal region;

e) a means for ~~comparing~~ analyzing the results obtained in d) ~~with~~ and the results obtained in e~~), wherein~~ so that the lens stack ~~is~~ can be modified to provide an electron kinetic energy of 2 meV or less and at least 5 reflections at the reversal region;

f) an ion extraction component in ion communication with the reversal region; and

g) a mass analyzer in ion communication with the extraction component,

wherein electrons <u>can</u> attach to the target molecule ~~generating~~ <u>to generate</u> a detectable negative ion.

21. (Original) The apparatus of claim 20, wherein the jet injector is made of stainless steel.

22. (Original) The apparatus of claim 20, wherein the jet injector further comprises a heating element.

23. (Original) The apparatus of claim 22, wherein the heating element maintains the jet injector at 140 C.

24. (Original) The apparatus of claim 20, wherein the mass analyzer is a quadrupole mass analyzer.

25. (Original) The apparatus of claim 20, wherein the optic chamber, ion extraction component and mass analyzer are contained in a vacuum chamber.

26. (Original) A device for inhibiting deposition of a non-conductive substance on the inner surface of an electrostatic analyzer, the device comprising a non-solid material covering an aperture integrally-associated with the electrostatic analyzer, wherein said aperture is in the line of sight of an electron emitter, and wherein the device substantially maintains the integrity of an electrostatic field and permits the flow of negative ions through the electrostatic analyzer.

27. (Original) The device of claim 26, wherein the device is releasably connectable to the inner surface of the electrostatic analyzer.

28. (Original) The device of claim 26, wherein the electrostatic analyzer is a hemispherical electrostatic analyzer.

29. (Original) The device of claim 26, wherein the non-solid material comprises a plurality of openings that reduce the surface area of the electrostatic analyzer outer wall by about 10 to 90%.

30. (Original) A method for inhibiting deposition of a non-conductive substance on the inner surface of an electrostatic analyzer, the method comprising contacting a non-solid material covering an aperture integrally-associated with the electrostatic analyzer with positive ions and negative ions, wherein said aperture is in the line of sight of an electron emitter, and wherein said material substantially maintains the integrity of an electrostatic field and permits the flow of negative ions through the electrostatic analyzer.

31. (New) The method of claim 1, wherein modifying the geometry of the lens stack comprises modifying a shape of an element in the lens stack.

32. (New) The method of claim 1, wherein modifying the lens stack comprises modifying a position of an element in the lens stack.

33. (New) The method of claim 1, further comprising determining the geometry of the lens stack.

34. (New) The method of claim 1, wherein determining the fields and trajectories for the electrons comprises determining the fields and trajectories by analytically determining the axial and radial kinetic energy of electrons.

35. (New) The method of claim 1, wherein the reversal region comprises a plurality of spherical equipotentials.

36. (New) The method of claim 1, wherein intersecting the reversal region with the target molecular gas beam comprises intersecting the reversal region with the target molecular gas beam comprising toxic substances produced by manufacturing plants.

37. (New) The method of claim 1, wherein intersecting the reversal region with the target molecular gas beam comprises intersecting the reversal region with the target molecular gas

beam comprising toxic substances produced by a manufacturing plant.

38. (New) The apparatus of claim 17, wherein the means for matching the geometry of said lens stack to the geometry of said electron emitter comprises a means for modifying the geometry of the lens stack.

39. (New) The apparatus of claim 20, wherein the means for modifying the geometry of the lens stack comprises a means for modifying a shape of an element in the lens stack.

40. (New) The apparatus of claim 20, wherein the means for modifying the geometry of the lens stack comprises a means for modifying a position of an element in the lens stack.

41. (New) A chemical sensing apparatus for detecting the presence of a target molecule, the apparatus comprising:

an electron-ion optic chamber comprising

an electron emitter to generate electrons,

a modifiable lens stack to focus the emitted electrons along an axis to a reversal region and neutralize the kinetic energy of the electrons in the reversal region, the geometry of the lens stack being modifiable based on fields and trajectories of the electrons generated by the electron emitter and the number of reflections made by the electron beam in the reversal region to provide an electron kinetic energy of 2 meV or less and at least 5 reflections at the reversal region, and

an ion extraction component in ion communication with the reversal region; and

a mass analyzer in ion communication with the ion extraction component,

wherein electrons can attach to the target molecule to generate a detectable negative ion that is extractable by the ion extraction component.

42. (New) The apparatus of claim 41, further comprising a means for modifying the lens stack to provide the electron kinetic energy of 2 meV or less and at least 5 reflections at the reversal region.

43. (New) The apparatus of claim 41, wherein the reversal region comprises a plurality of spherical equipotentials generated at least in part by the modifiable lens stack.